STS 132 Return Samples: Assessment of Air Quality aboard the Shuttle (STS-132) and International Space Station (ULF4)

Space Shuttle: The toxicological assessments of 2 grab sample canisters (GSCs) from the Shuttle are reported in Table 1. Analytical methods have not changed from earlier reports. The recoveries of the 3 surrogates (^{13}C-acetone, fluorobenzene, and chlorobenzene) from the 2 Shuttle GSCs averaged 93, 85%, and 88 %, respectively. Based on the end-of-mission sample, the Shuttle atmosphere was acceptable for human respiration.

Table 1. Analytical Summary of Shuttle Samples

Sample Location	Date of Sample	NMVOCs [a] (mg/m^3)	Freon 218 (mg/m^3)	T Value[b] (units)	Alcohols (mg/m^3)	Formaldehyde ($\mu g/m^3$)
Preflight	5/14/10	0.1	<0.025	0.01	0.06	--
Mid-deck (end of mission)	5/26/10	3.0	22[d]	0.18	0.89	--
Guideline		*25*	*none*	*1.0*	*none*[c]	*<120*

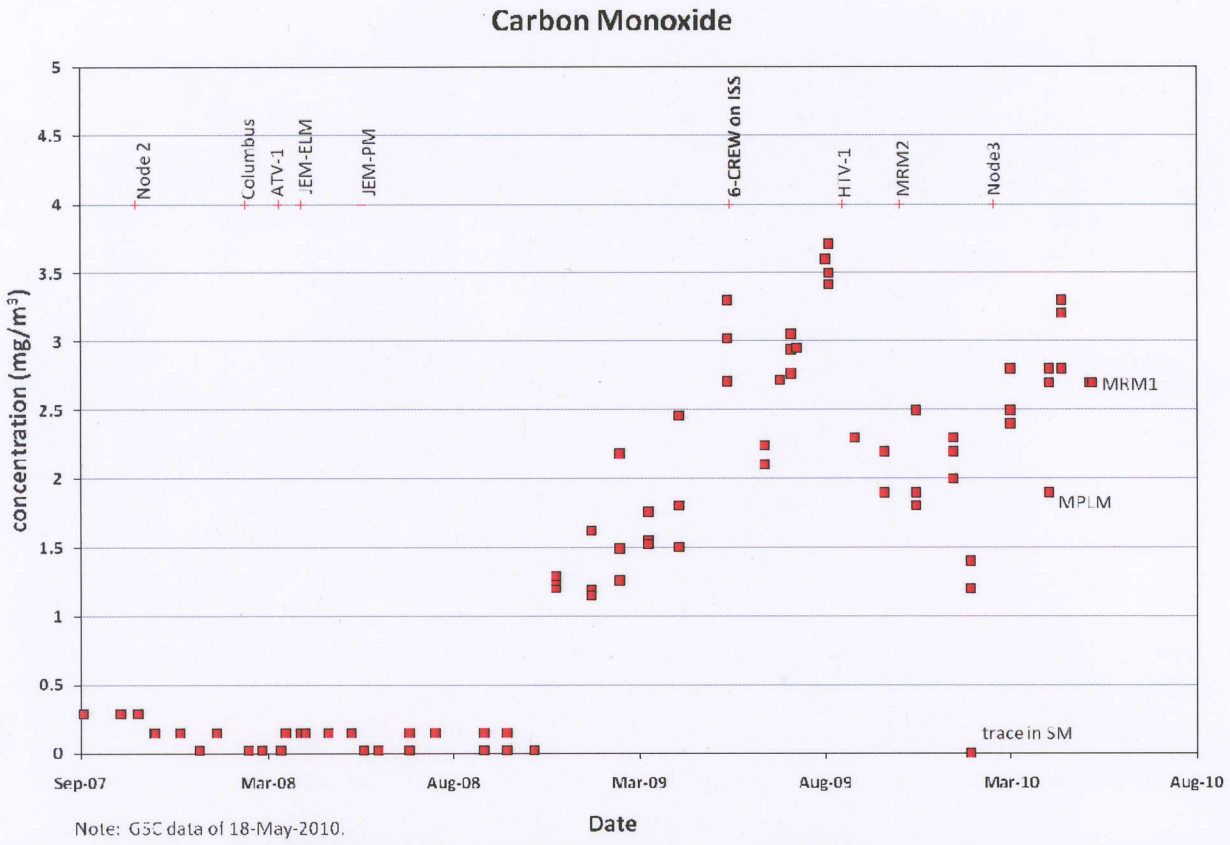
[a] Non-methane volatile organic hydrocarbons, excluding Freon 218
[b] Based on 7-day SMACs and calculated excluding CO_2, formaldehyde, and siloxanes.
[c] There is no guideline value because water is not recovered from humidity condensate on Shuttle as it is on ISS.
[d] This is residual from the ISS during docked phase.

International Space Station: The toxicological assessment of 7 GSCs from the ISS is shown in Table 2. The recoveries of the 3 standards (as listed above) from the GSCs averaged 78, 96 and 90%, respectively. Recovery from formaldehyde control badges ranged from 90 to 112%.

Table 2. Analytical Summary of ISS Results

Module/Sample	Approx. Date of Sample	NMVOCs[a] (mg/m^3)	Freon 218 (mg/m^3)	T Value[b] (units)	Alcohols (mg/m^3)	Formaldehyde ($\mu g/m^3$)
JEM	4/20/10	5.3	64	**1.07**[c]	3.3	--
Lab	4/20/10	4.9	65	0.36	3.6	35
SM	4/20/10	7.5	60	0.38	**6.0**[c]	46
SM	5/18/10	6.0	48	**1.08**[c]	3.9	--
Lab	5/18/10	5.7	47	0.34	4.1	--
Columbus	5/18/10	5.7	54	0.96[c]	3.6	--
MRM1 (first entry)	5/20/10	17	39[d]	1.70	8.1	--
Guideline		*<25*	*none*	*<1.0*	*<5*	*<120*

[a] Non-methane volatile organic hydrocarbons, excluding Freon 218
[b] Based on 180-d SMACs and calculated excluding CO_2, formaldehyde, and siloxanes.
[c] Higher T value is due to traces of propenal, a mucosal irritant. High alcohol is due to methanol.
[d] The relatively high value for Freon 218 suggests that capture of the first-entry sample was delayed, allowing diffusion from the ISS into the atmosphere of the newly-opened module.



Carbon Monoxide Accumulation aboard ISS: From late 2008 the nominal concentrations of CO had been increasing gradually (see figure above). The results from samples returned on this flight indicate that the CO concentrations, after dropping in late 2009, have cycled upward. In any case, these changes are well below the 180-day SMAC for CO, which is17 mg/m^3. There is no threat to crew health. The source of the additional CO is unknown.

General Observations about ISS Air Quality:

This is a very limited set of samples on which to perform an air quality assessment. However, based on these samples, we have no reason to believe that nominal ISS air is unsafe to breathe. Past observations of sporadic elevations of propenal have recurred, but at a lower level. We must continue to be vigilant when dealing with nominal atmospheres in ISS. New, unmanned modules, such as the MRM1, require special attention when the crew first enters.

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Enclosures

Table 1A: Analytical concentrations of compounds found in the STS-132 GSCs
Table 1B: Analytical concentrations of compounds found in ULF4 GSCs
Table 2A: T-values of the compounds in table 1A
Table 2B: T-values of the compounds in table 1B